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AUTHOR Johnson-Greene, Douglas; And Others
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ABSTRACT

Although caffeine is seemingly harmless in ordinary daily intake, there has been increasing concern about the possible side effects of habitual caffeine ingestion. The excessive daily ingestion of caffeine in the form of coffee, soda pop, tea, and various medications may lead to a chronic disorder known as caffeinism. This study tested the efficacy of behavioral management of excessive caffeine consumption. Primary treatment components included changing criterion, self-monitoring, didactic information and public announcement, contingency contracting and response cost, incompatible responses, and alternative stimulation. It was expected that the three subjects would increase self-management skills and maintain appropriate caffeine consumption following treatment. Treatment and follow-up results substantiated these expectations. Subjects' daily caffeine consumption decreased from over 900 milligrams during baseline (the equivalent of over eight cups of coffee) to less than 300 milligrams during maintenance. The results appear to support the suggested effectiveness of behavioral interventions in the treatment of excessive caffeine consumption. Figures and tables are provided. (NB)

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Behavioral Management of Excessive Caffeine Consumption: Three Case Studies[3]

Douglas Johnson-Greene M.A.[2]
Michael Fatis Ph.D.[1,2]
Donna Sonnek[2]
Carita Shawchuck[2]

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1. To whom correspondence should be addressed.

2. Psychology Department, Mankato State University, Mankato, Minnesota 56001

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Abstract

Behavioral Management of Excessive
Caffeine Consumption: Three Case Studies

The excessive daily ingestion of caffeine in the form of coffee, soda pop, tea, and various medications may lead to a chronic disorder known as caffeinism. This study tested the efficacy of behavioral management of excessive caffeine consumption. Primary treatment components included changing criterion, self monitoring, didactic information and public announcement, contingency contracting and response cost, incompatible responses, and alternative stimulation. It was expected that subjects would increase self management skills and maintain appropriate caffeine consumption following treatment. Treatment and follow-up results substantiate treatment expectations. Subjects' caffeine consumption decreased from over 900 mg during baseline (the equivalant of over eight cups of coffee), to less than 300 mg during maintenance. The results were interpreted as being supportive of the suggested effectiveness of behavioral interventions in the treatment of excessive caffeine consumption.

Review of the Literature

Although caffeine is seemingly harmless in ordinary daily intake, there has been increasing concern about the possible side effects of habitual caffeine ingestion. Many disease states have implicated caffeine as a possible etiological factor, and literature concerning caffeine's psychological effects dictates a need to reexamine this common stimulant.

The excessive daily ingestion of caffeine in the form of coffee, soda pop, tea, and various medications may lead to a chronic disorder known as caffeinism (DSM III; Foxx & Rubinoff, 1979; Curtalo & Robertson, 1983; James & Stirling, 1983). Characteristics of caffeinism range from mild physiological responses such as: insomnia, irritability, tremulousness, and diuresis (Victor, Lubetsky and Greden, 1981; Curtalo and Robertson, 1983), to more pronounced psychological symptoms such as depression and anxiety (Greden, Fontaine, Lubetsky and Chamberlin, 1978; Greden, 1974, 1980; Gilliland and Bullock, 1984).

In addition, there is growing evidence that caffeine may be a contributing factor in the development of a number of disease states (James & Stirling, 1983). Conditions such as: cardiovascular disease (Kannell, 1977; Dawber, Kanner and Gorden, 1974; Thelle, Arnesen and Forde, 1983; Rosenberg, Slone, Shapiro and Kaufman, 1980; Stanton, Ahrens and Douglass, 1978), and birth defects (Linn et al., 1982; Weathersbee, Olsen and Lodge, 1977; Rosenberg, Mitchell,

Shapiro and Stone, 1982) have been linked to excessive use of caffeine. Other disease states that have been implicated include cancer of the bladder (Morrison et al., 1982; Marrett and Walter, 1982; Cole, 1971), cancer of the pancreas (MacMahon, Yen, Trichopolous, Warren and Nardi, 1981) and cancer of the gastrointestinal tract (Friedman, Siegelaub and Seltzer, 1974). Despite the deleterious effects of habitual caffeine use it is estimated that 16-20% of the U.S. population consumed dangerous levels of caffeine on a daily basis (Gilliland and Bullock, 1984; Wells, 1984), making coffee the most widely used central nervous system stimulant.

Behavioral Management of Caffeinism

The psychological treatment modalities which have been investigated extensively and have had the greatest success have focused on behavioral therapies. Two studies by Foxx and Rubinoff (1979) implemented a changing criterion design to systematically and gradually reduce daily caffeine ingestion. Coffee drinkers were required to self monitor and plot their daily caffeine intake. Other behavioral methods that were implemented include: contingency contracting, response cost, social reinforcement, monetary reinforcement, and didactic information regarding health risks associated with caffeine use.

Results of the 40 month follow-up for this program, according to the author, revealed that all three subjects were still consuming less than 600 mg. of caffeine per day (Foxx, 1982). However, subjects were asked to record caffeine containing beverages for only two days, thus increasing the probability that they would reduce their caffeine intake for only the two days they were self monitoring to comply with experimental demands and expectancies. Another study by Bernard, Dennehy and Keefauver (1981), was a partial replication of the Foxx and Rubinoff (1979) study. Results from the study indicate that the changing criterion design composed of self monitoring, social praise, and response cost was a reasonable method of reducing coffee and tea intake.

One study by James, Stirling and Hampton (1985) used a factorial experimental design to examine the effectiveness of specific behavioral components. The study included three groups of subjects, self initiated, caffeine fading, and caffeine fading plus relaxation. It was presumed that the addition of relaxation training would aid in the management of the two most frequent symptoms of caffeine withdrawal, headache and anxiety. Results of the study confirmed the efficacy of caffeine fading as a treatment for excessive caffeine consumption but failed to demonstrate further benefits arising from the addition of relaxation training.

One additional study (Hyner, 1979) utilized relaxation as the principle treatment for a single subject engaging in

excessive cigarette use and caffeine ingestion. Despite the reported reductions in cigarette and caffeine use, the use of only one subject and lack of follow-up measures precludes any firm conclusions regarding the use of relaxation training in this study.

There are several factors which the aforementioned studies have failed to control. Prior studies are unable to control for self induced change or success of a program as a function of time. Another problem seems to concern the lack of maintenance procedures and provisions for fading the treatment procedures. Monetary incentives were made contingent for lowering caffeine consumption and not for self monitoring compliance, thus promoting poor generalization following treatment. Use of participant observers as a means of reliability of the subject's self report, has historically consisted of subjective impressions of the subject's caffeine consumption instead of quantifiable data. Finally, subjects typically record only beverage products such as coffee, tea, and cola drinks. Because over the counter medication and products containing smaller amounts of caffeine were not recorded the total caffeine reported in studies may be only a reflection of the actual amount consumed.

Methodology

Subjects

Three of six respondents that expressed an interest in being involved in this project were included in the study. All subjects resided in a small rural community of Southern Minnesota and learned of the services provided by this research project through program descriptions that were distributed. In addition, the three subjects met the following criteria: (1) concern about the biological and/or behavioral effects caffeine consumption had caused, contibuted to or exacerbated; (2) prior attempts to lower or abstain from caffeine consumption had failed; and (3) a genuine desire to lower caffeine consumption.

Experimental Design

The experimental design used in this study was an A-B single case design with changing criterion (Hartmann and Hall, 1976) employed to gradually and systematically reduce participants caffeine consumption over a 4 week treatment period.

Procedure

Preliminary Considerations

Prior to formal admission to the Caffeine Reduction Program, subjects took part in an informal interview to

ascertain preliminary levels of caffeine ingestion, problems associate with caffeine ingestion, and to review and sign an informed consent document. Due to the extent of two of the participants medical concerns, physician referral and consultation was required.

In addition, participants were asked to complete a questionnaire first developed by Foxx and Rubinoff (1979) that asked the following: (1) demographic and biographical information; (2) the number of cups of coffee consumed daily; (3) the number of years they had drunk coffee daily; (4) the brands and types of coffee consumed; (5) their reasons for wanting to reduce their caffeine consumption; (6) their longest period of abstinence since they had become regular coffee drinkers; (7) to list and rank order the beverages they had consumed regularly; and (8) to list any prescription medications or over the counter stimulants taken daily and their dosages.

Treatment Components

Treatment consisted of several primary components: training in self monitoring (phase 1), didactic information and public announcement (phase 2), contingency contracting, response cost, changing criterion (phase 3); and maintenance and fading (phase 4).

During phase 1 participants were instructed to monitor all products containing caffeine on a continual basis in the natural environment. At the end of each day, participants

would graph their total daily caffeine consumption on a graph supplied by the experimenter.

During phase 2 participants were asked to read a brief summary of the effects of caffeine. The article provided didactic information regarding the hazardous physical and behavioral effects commonly associated with caffeine use. In addition, participants were also asked to make a public announcement to their work colleagues of their intent to lower their caffeine use. It was hoped that the peer pressure associated with making a public commitment would aid participants in reducing their caffeine consumption.

During phase 3 participants were required to deposit twenty dollars, half of which was returned in four equal steps during the treatment phases, and the other half at the end of the three month follow up contingent upon completion of self monitoring caffeine consumption as described within the contract. It is important to note that no added monetary incentives were given as in past studies. In addition, during the four treatment phases, a changing criterion was used to indicate suggested levels of caffeine consumption to promote a gradual step wise reduction (Hartmann & Hall, 1976). The goal of all subjects was to decrease daily caffeine consumption from their baseline level to 300 mg., the amount which research fails to indicate any adverse effects. The 300 mg. figure was subtracted from each baseline mean and then divided by four

treatment phases to yield the amount of caffeine reduction in mg. for each treatment phase.

During phase 4 participants were encouraged to sample non-caffeinated products such as soda pop or tea and then to select preferred non-caffeinated products instead of caffeinated products. Participants were also encouraged to make caffeine products less accessible. Participants were encouraged to place coffee pots in closets, hide coffee cups in drawers. In addition, participants were encouraged to engage in physical activity at times that had previously been associated with high caffeine consumption. Activities that were suggested included jogging, taking brisk walks, and riding a bicycle.

Treatment Reliability

The present study utilized participant observers to corroborate subject's self reported caffeine consumption. Participant observers were asked to observe and objectively record each subject's caffeine consumption on a continual basis. Prior to admission in the study, subjects submitted the names of two significant others who would be willing to monitor the subject's caffeine consumption on a continual basis throughout the study and at follow-up. Participant observers were instructed to utilize the same monitoring procedures used by subject's and to mail their records to the experimenter on a weekly basis.

Dependent Measures

Four self report indices and tests were used for assessment and evaluation of treatment outcome: caffeine consumption, daily diary page, State Trait Anxiety Inventory and the Beck Depression Inventory.

Each day of the program, participants recorded the number of cups of coffee and other caffeine containing products they had consumed. Their recording forms contained the caffeine content of common caffeine products. After consuming a product containing caffeine, the participant recorded its caffeine content, the activity associated with its consumption, and the total intake of caffeine to that moment. In this manner participants could keep a running total of the total amount of caffeine consumed in mgs. for any given point in the day. At the end of the day, participants were asked to graph the total caffeine consumption for that day on sheets provided at the beginning of treatment.

Participants used the Daily Diary Page (Fordyce, 1976) to record the time of occurrence, type and duration of activity. Analysis of daily diary pages may provide a correlation between amount of activity as it relates to the consumption of products containing caffeine. The Daily Diary Page were used daily during maintenance.

Participants also completed two inventories to assess changes in depression and anxiety subsequent to reduction of caffeine during each session and at follow-up. The Beck

Depression Inventory was used as a measure of change in severity of depression while the State-Trait Anxiety Inventory was used as a measure of change in frequency of state anxiety behaviors when compared to trait anxiety behaviors associated with reduction of caffeine consumption.

Results

A review of Ms. S.'s daily caffeine consumption indicates a steady decline in total caffeine consumption. As illustrated by Figure 1, mean daily intake of caffeine decreased from a baseline of 540 mg to 225 mg (a decrease of 315 mg) during maintenance. Ms. S.'s mean daily intake of caffeine during the 3-month follow-up was 352 mg. A comparison of participant observer observations confirm a downward trend in total caffeine consumption.

A review of Ms. L.'s caffeine consumption also indicates a gradual decline in total caffeine consumption. As illustrated by Figure 2, mean daily intake of caffeine decreased from a baseline of 841 mg to 253 mg during maintenance (a decrease of 588 mg or over 4 cups of brewed coffee). Ms. L.'s mean daily intake of caffeine during the 3-month follow-up was 189 mg. A comparison of participant observer observations indicate that a decline in caffeine consumption had occurred and that Ms. L. rarely exceeded suggested criterion levels.

Ms. K.'s caffeine consumption indicates a more gradual decline in total caffeine consumption. As illustrated by

Figure 3, mean daily intake of caffeine decreased from a baseline of 1165 mg to 350 mg during the maintenance condition, a reduction of 815 mg. Ms. K.'s mean daily intake of caffeine during the 3-month follow-up was 357.1 mg. A comparison of participant observer observations appears to only partial confirm reported caffeine consumption as a large quantity of data is not available.

Additional Findings

A summary of subject's daily diary data can be viewed in Table 1. Ms. S., reported 45.4 minutes of activity, and Ms. L., 27.5. Although there is no baseline for comparison, self report levels of activity would suggest that these two subjects were regularly engaging in activity and were complying with treatment suggestions. However, Ms. K.'s reported 3.2 minutes of activity per day would suggest noncompliance with treatment suggestions.

Results of the Beck Depression Inventory data can be viewed in Table 2. Clinical elevations occurred most often during treatment phases when subjects were decreasing their caffeine consumption. Scores for maintenance and follow-up conditions are lower than baseline and treatment conditions.

The same phenomenon can be observed in viewing State Trait Anxiety Inventory data in Table 3. Clinical elevations were observed in treatment phases. Scores were significantly lower for maintenance and follow-up conditions.

Discussion

The purpose of this study was to test the efficacy of a behavioral treatment program for excessive caffeine consumption. The results showed that the program was effective in reducing excessive caffeine consumption to moderate and presumably safer levels. All participants made positive gains in their ability to reduce and maintain appropriate levels of caffeine consumption during the course of the program.

The participants' caffeine consumption decreased from an average of approximately 900 mg (over seven cups of coffee) during baseline to less than 300 mg (less than three cups of coffee) at the end of treatment. Daily caffeine data taken throughout the program is indicative of the results. Figures 1, 2 and 3 show the daily caffeine consumption for each participant. Ms. S had decreased her mean daily intake of caffeine by 58%, Ms. L. by 69.9% and Ms. K. by 70%. This effect was maintained over a 3 month follow-up; the participants averaged a 65% reduction from baseline. Wide fluctuations in caffeine consumption were most common in baseline and pre-treatment conditions. This suggests that the treatment may have taught skills that not only lowered caffeine consumption but also controlled caffeine consumption variability. These wide fluctuations may have accounted for not only the initially high scores

on the Beck Depression Inventory and the State-Trait Anxiety Inventory but also for many of the participants' presenting problems such as nervousness.

Factors that may have influenced the participants to reduce caffeine consumption include: the information they received on the deleterious effects of caffeine, the relative amounts of caffeine in various beverages, minimal encouragement received from experimenters, the participants' motivation to reduce their caffeine consumption as evidenced by volunteering for the study, and social pressure associated with making a public announcement to reduce caffeine consumption. However, the inclusion of a self induced change condition may in part control for many of these factors and in fact demonstrate that the reduction in caffeine consumption was primarily due to the implementation of the treatment components.

Several possible extraneous variables may have occurred during this program which complicate interpretation of the results. Ms. L. and Ms. K. were observed on several occasions to have not totalled their daily caffeine consumption or graph their data for the week. They were both reminded at these times of the importance of keeping a cumulative total of their caffeine consumption throughout the day and to graph the daily total each and every day. Because self monitoring is such a vital component of the program the short term effect of not strictly adhering to

self monitoring procedures may have been slight elevations in caffeine consumption.

Lack of baseline or follow-up data for activity levels prevents conclusive statements regarding the effect of this intervention on dependent measures. However, two participants, Ms. S. and Ms. L. appear to have a high activity level and may have in fact increased their activity level as requested. The participants reported that they had increased their activity level since involvement in the program. The lack of follow-up data makes it impossible to determine whether activity levels were maintained.

In addition, the use of the A-B experimental design does not allow for the interpretation of treatment outcomes as a function of treatment implementation. Instead, outcomes may be a function of time. Finally, all data were obtained through self report. Reliance on self report data leaves a question of accuracy of the data base, although much of the data was supported by participant observers.

Future behavioral programs for treating caffeinism should emphasize the introduction of only one treatment variable at a time to observe the effect on dependent measures. Because a component analysis is not possible in the present study it is unknown what effect specific treatment components or the order of treatment components had on dependent measures.

It would appear that increased activity levels may be a valuable component in caffeine reduction programs. In

addition, longer follow-ups should be conducted to ensure maintenance of treatment objectives. The present study should be viewed as a continuing step in the development of an effective behavioral treatment program for treating excessive caffeine consumption.

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Table 1

Summary of Daily Diary Data (Minutes)

Condition[a]	Ms. S.	Ms. L.	Ms. K.
Maintenance (8-9)	$\bar{X}$ = 45.4 SD = 47.2	$\bar{X}$ = 27.5 SD = 27.2	$\bar{X}$ = 3.2 SD = 2.5
Follow-up	$\bar{X}$ = * SD = *	$\bar{X}$ = * SD = *	$\bar{X}$ = * SD = *

* Data not available.

[a] Numbers in parentheses indicate program week.

Figure 2

Summary of Beck Depression Inventory Scores

Condition	Ms. S.	Ms. L.	Ms. K.
Baseline	8	10	4.5
Pre-Trmt.	4	8	6
Treatment Phase 1	8	7	3
Treatment Phase 2	13	7	3
Treatment Phase 3	7	6	6
Treatment Phase 4	11	3	5
Maintenance	6	6.5	6
Follow-up	5	1	5

Note. Low scores are indicative of a low frequency of endorsing items associated with depression while high scores are indicative of a high frequency of endorsing items associated with depression.

Table 3

Summary of State-Trait Anxiety Inventory Data

Condition	Ms. S.		Ms. L.		Ms. K.	
	state	trait	state	trait	state	trait
Baseline	46	40	35	43	34	30
Pre-Trmt.	43	40	32	33	48	29
Treatment Phase 1	45	46	30	33	34	30
Treatment Phase 2	53	48	47	41	43	36
Treatment Phase 3	44	39	35	35	34	34
Treatment Phase 4	41	40	24	35	31	32
Maintenance	41	42	36	36	44	30
Follow-up	36	31	26	33	22	29

Note. Low scores are indicative of low frequency of endorsing items associated with anxiety while high scores are indicative of a high frequency of endorsing items associated with anxiety.

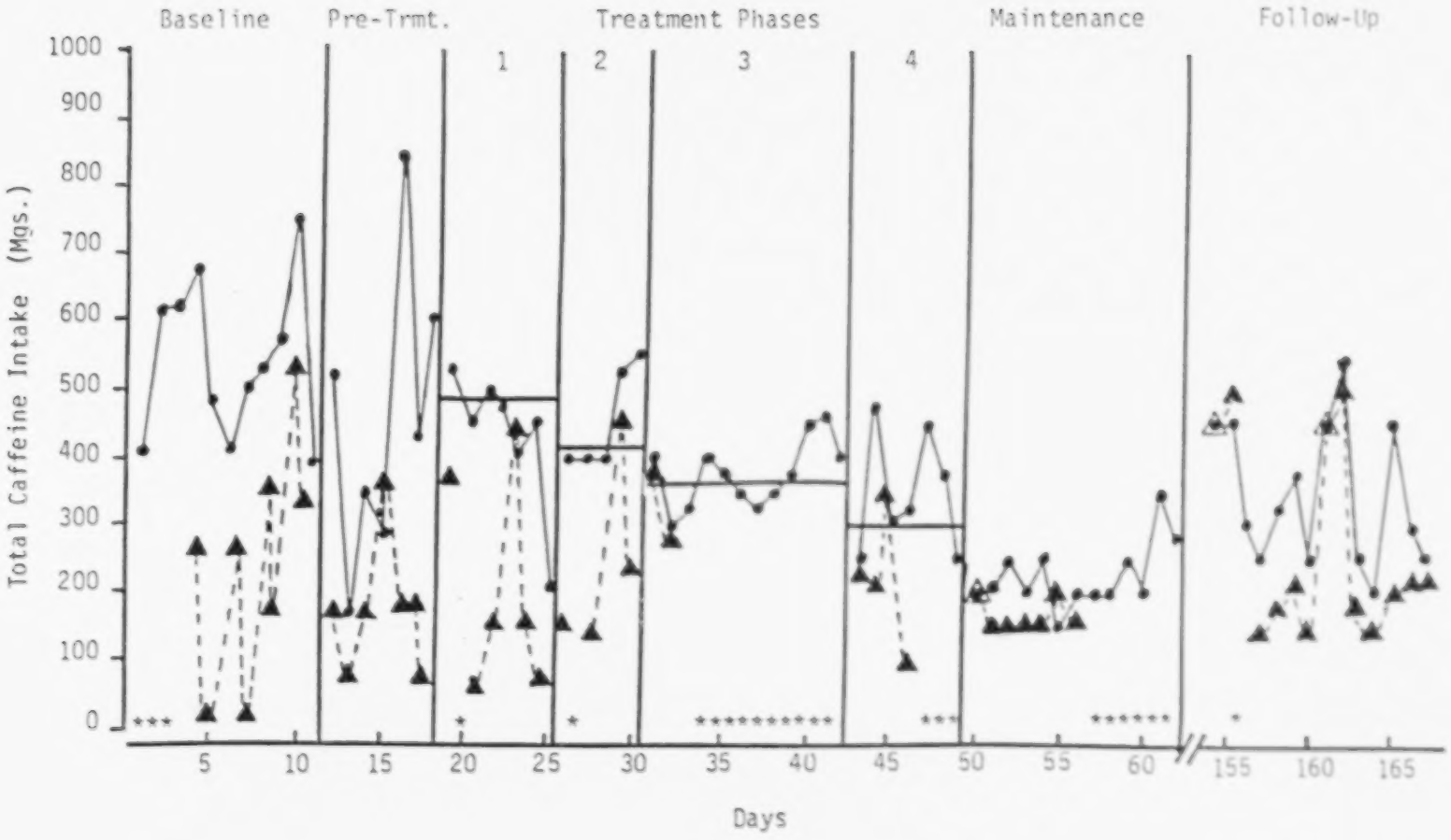

Figure 1: Graphic Display of Ms. S's Participant Observer Observations
Solid horizontal lines indicate the criterion for each treatment phase.

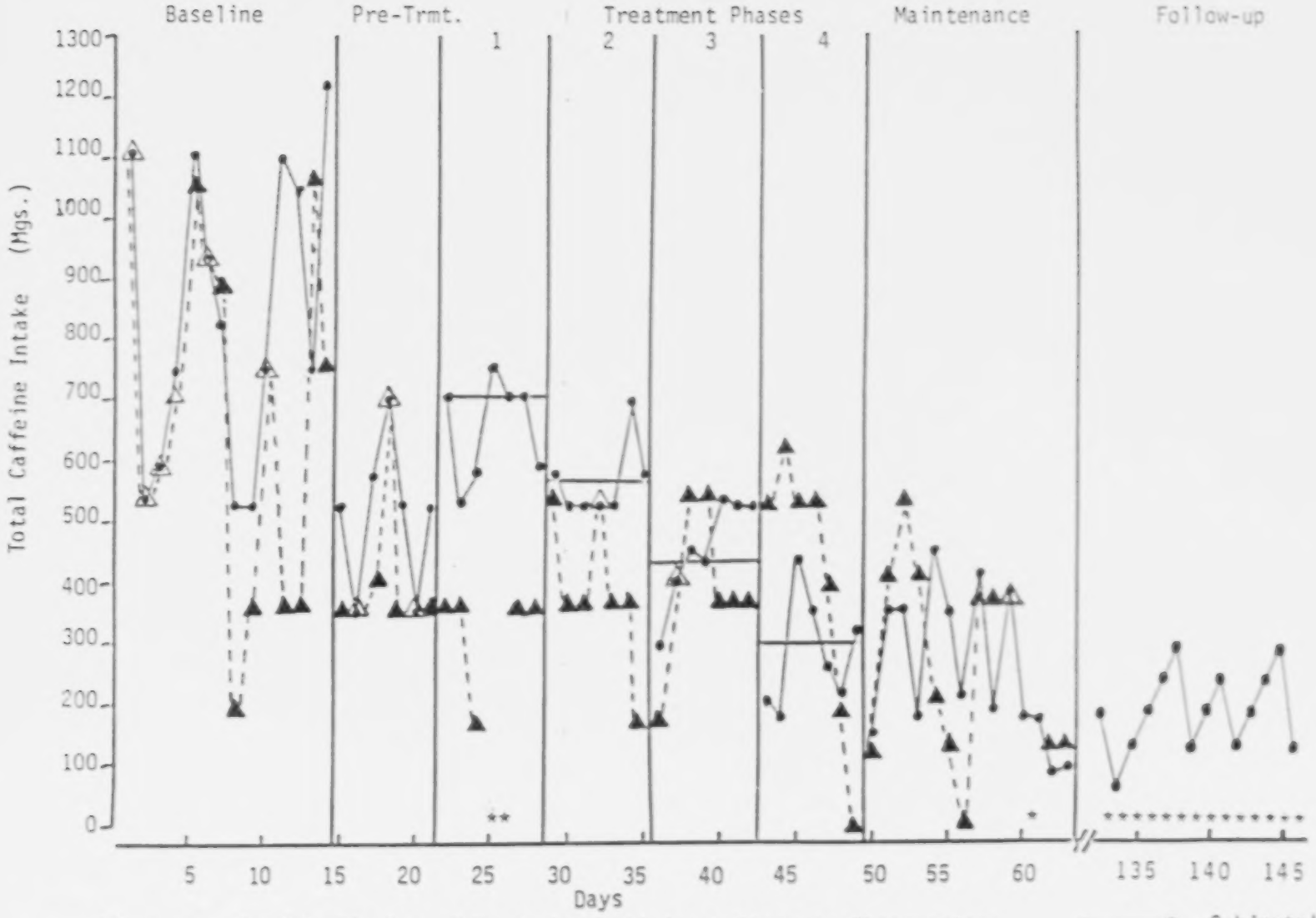

Figure 2: Graphic Display of Ms. L.'s Participant Observer Observations
Solid horizontal lines indicate the criterion for each phase.

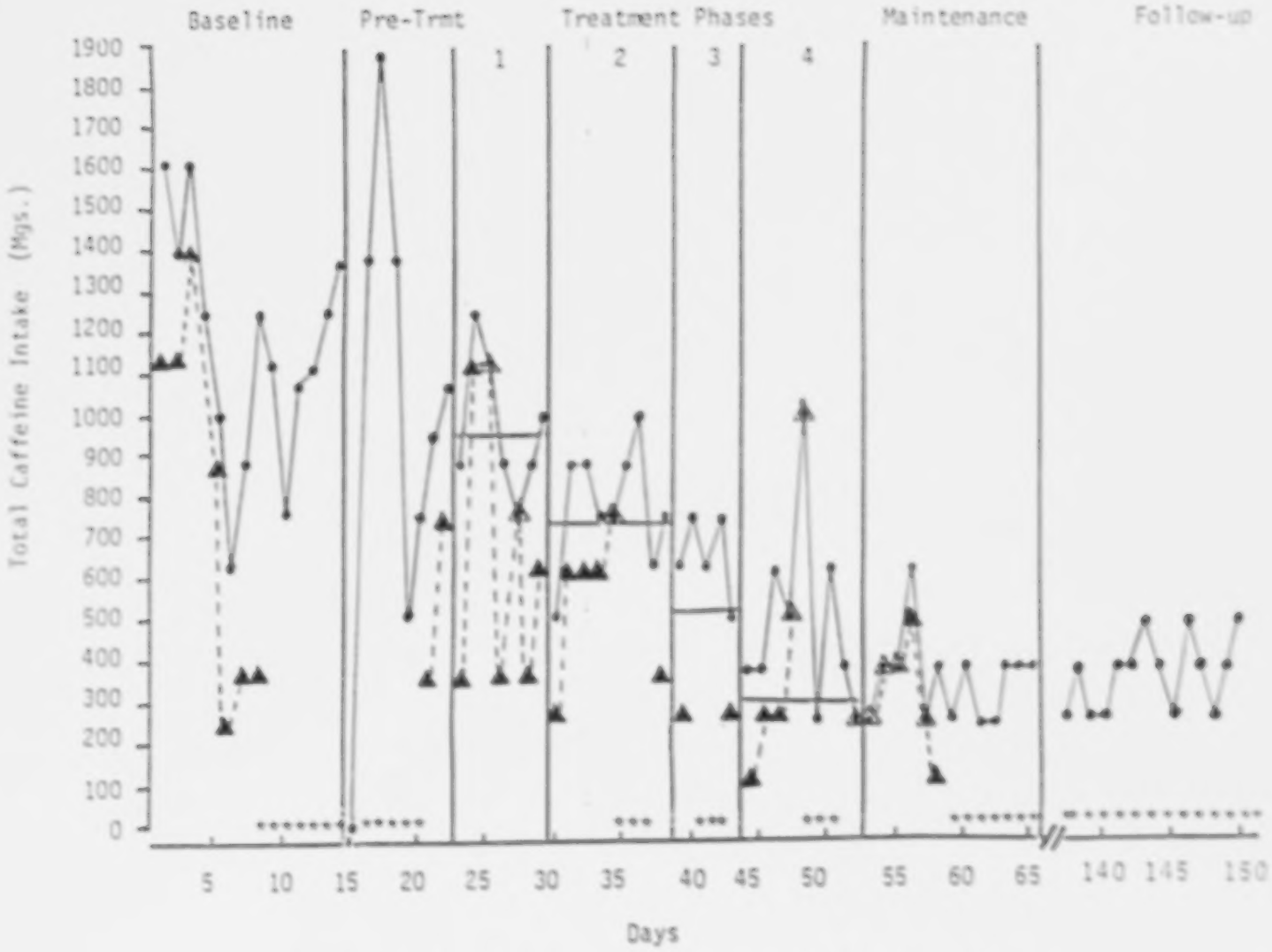

Figure 3: Graphic Display of Ms. K.'s Participant Observer Observations
Solid horizontal lines indicate the criterion for each treatment phase.